MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

TCS1011 – DATA STRUCTURES AND ALGORITHMS

(All groups)

29 FEBRUARY 2016
9:00 AM – 11:00 AM
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages only (including this page).
2. Attempt **ALL** questions. The distribution of the marks for each question is given.
3. Print all your answers in the Answer Booklet provided.
4. State all assumptions clearly.

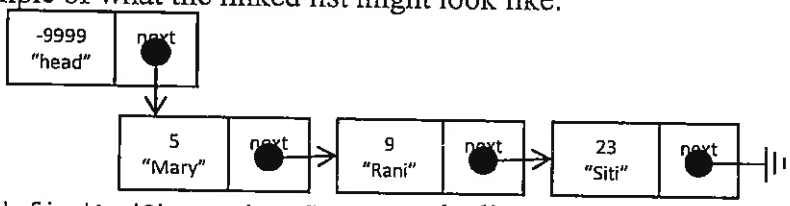
Question 1

Given this definition of a Linked List node:

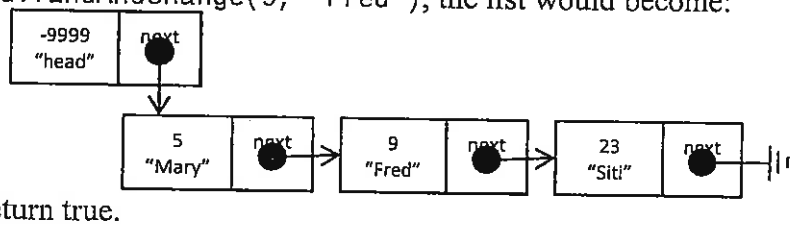
LinkedList.hpp

```
#ifndef LINKEDLIST_HPP

#define LINKEDLIST_HPP

#include <limits.h>
#define HEADNODE INT_MAX

class LLnode
{ LLnode* next;
public:
  int key;
  string value;
  void insert(LLnode *newLLnode );           // Insert node in front:
  bool findAndChange(int key, string value); // Change node with key to value
};                                           // and return false if not found.
#endif
```

Here is an example of what the linked list might look like:

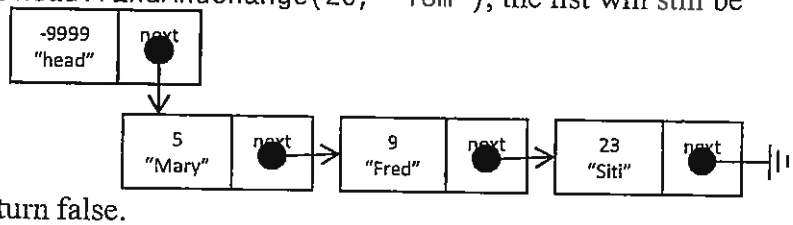


If you call `head.findAndChange(9, "Fred")`, the list would become:



and it would return true.

If you then call `head.findAndChange(20, "Tom")`, the list will still be



but it would return false.

Write the C++ code for `findAndChange()`, and make sure to take care of the case that `head->next` is `NULL`. For full marks, **you must use recursion**. Note that `findAndChange()` is called on the head object. [10 marks]

Question 2

Restaurant Directory is a program that lists the restaurants in town. It will need to allow users to add and delete reviews of each restaurant. When a new restaurant opens, it will need to be able to add the new restaurant. When a restaurant closes, it will need to be able to delete the restaurant. Users will also need to be able to search through the list of restaurants easily to find the restaurant they want.

a) Would it be better to use an array-based list or a linked list to store the comments for each restaurant? Explain your choice. [4 marks]

b) Would it be better to use a hash table or a binary search tree to store the restaurants? Explain your choice. [4 marks]

c) Would it be better to throw away the lists, hash tables, and trees and replace the whole thing with a graph? Explain why. [4 marks]

Question 3

What is the time complexity in Big-O notation for each of the following functions?

a)
```
void bilbo(int data)
{ for (int i=0; i<data; i++)
    for (int j=0; j<data; j++)
      cout << i << ' ' << j;
}
```
[2 marks]

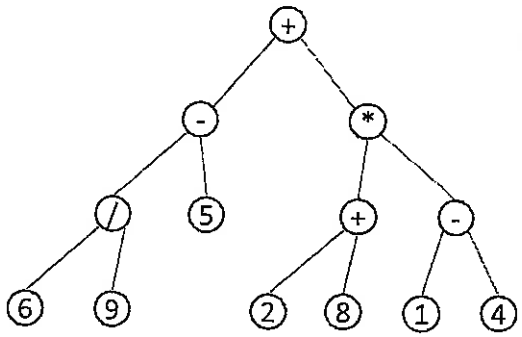
b)
```
void frodo(int data)
{ for (int i=0; i<data; i++)
    for (int j=0; j<i; j++)
      cout << i << ' ' << j;
}
```
[2 marks]

c)
```
void gandalf(int data)
{ if (data>0)
  { cout << data;
    gandalf(data-1);
  }
}
```
[2 marks]

d)
```
void aragorn(int data)
{ for (int i=0; i<data; i++)
    gandalf(i);
    // Assume the same gandalf() as in (c)
}
```
[2 marks]

Question 4

Given this tree:



a) Give the infix traversal of this tree. [3 marks]

b) Give the postfix traversal of this tree. [3 marks]

c) Give the prefix traversal of this tree. [3 marks]

d) If this tree were interpreted as a graph, what would be the corresponding minimum spanning tree? [1 mark]

End of paper